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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/675,885	09/29/2003	Martin Heugel	59958 (70301)	6825

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EXAMINER	
EWALD, MARIA VERONICA	
ART UNIT	**PAPER NUMBER**
1722	

MAIL DATE	DELIVERY MODE
07/20/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/675,885	HEUGEL, MARTIN	
	Examiner	Art Unit	
	Maria Veronica D. Ewald	1722	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 May 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *12-24* is/are pending in the application.

4a) Of the above claim(s) *16-24* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *12-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *11 May 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

13. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on May 11, 2007 has been entered.

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 12 – 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Serbin, et al. (U.S. 5,753,171) in view of Friesem, et al. (U.S. 6,850,544). Serbin, et al. teach a device for the layer-by-layer manufacture of a three-dimensional object by means of selective hardening at those sites of a layer of a building material that correspond to the cross-section of the object through the use of a laser, the device comprising (column 1, lines 5 – 10): a laser (item 3 – figure 1; column 2, lines 34 – 35) that provides radiation; and a focusing unit that focuses the radiation to provide a

focused beam (item 8 – figure 1; column 2, lines 47 – 49); wherein the apparatus is further comprised of a beam expansion element (column 4, lines 1 – 10, 59 – 67; column 5, lines 1 – 25).

Furthermore, Serbin, et al. teach that during fabrication of an object, control and adjustment of the beam focus and diameter is necessary to obtain the best focusing degree and alignment of the beam (column 1, lines 63 – 65; column 2, lines 1 – 10). The reference continues by stating that to measure the diameter of the focus of the beam, a deflection device (item 5 – figure 1) and/or the positioning device is controlled so that the beam passes over a diaphragm aperture (item 20 – figure 5) of a sensor (column 4, lines 1 – 2). The intensity of the beam is scanned and its focus or diameter calculated (column 4, line 5). Thus, when a material layer is applied, the appropriate beam diameter can be calculated and set so that the layer is solidified correctly. Based on the calculated beam diameter, the control unit adjusts the focus device, deflection device and the laser itself, such that a smaller beam diameter is produced (column 4, lines 25 – 35). The smaller beam diameter is used in the envelope or outer regions to produce a finer and more accurate solidification, since the envelope region defines the contour of the object (column 4, lines 33 – 35). In contrast, when solidifying layers in the core or inner regions of the object, where accuracy is not as critical, a larger beam diameter is used to solidify the layers in a shorter amount of time, thereby, reducing production time overall (column 4, lines 38 – 40). Thus, Serbin, et al. teaches that control and adjustment of the beam is crucial to maintain efficiency.

Serbin, et al., however, do not explicitly teach the use of a switching element for changing the modal composition of the laser radiation which switches the modal composition of the omitted laser radiation between a first setting in which a fundamental Gauss mode is emitted and higher order modes are suppressed and a second setting in which the radiation contains additional higher modes and the overall power of the radiation is increased.

In a method to control the mode settings of a multimode laser, Friesem, et al. teach the use of an optical resonator and mode control elements (i.e, apertures and phase elements). Typical high-power lasers with large apertures have multimode patterns. The multimode pattern results in a beam of relatively low brightness and thus, such low brightness limits the usage of the laser in industrial processes where a small, well-defined focused spot or well collimated beam is necessary (column 1, lines 25 – 30). Typically, the fundamental or Gauss mode is used which possesses the highest brightness of all possible modes; however, this mode does not fill the entire gain medium diameter and thus, there exists a need to obtain different modes other than the Gauss mode, which will result in a large lasing volume (column 1, lines 45 – 55).

Friesem, et al., thus, teach the use of a mode control element in which a single mode or a set of modes can be utilized, depending on the user's needs (column 3, lines 45 – 50, 60 – 67). Thus, either a well-defined beam can be produced or when a set of modes is used, a high utilization of the gain medium diameter is achieved (column 4, lines 5 – 10). This reads on the Applicant's claims that the laser comprises a switching element which switches the modal composition of the laser between a first setting in

which only the Gauss mode is emitted and a second setting in which the radiation contains additional higher modes and the overall power of the radiation is increased and further reads on the claims that there is a beam expansion element and at least one mode aperture.

Thus, it would have been obvious to one of ordinary skill in the art at the time of the Applicant's invention to include with the device of Serbin, et al. the switching or mode control element of Friesem, et al. for the purpose of being able to control and switch a multimode laser beam such that a well-defined controlled phase in which the Gauss mode is utilized to selectively harden a single spot and subsequently go to another mode in which a set of modes is used to thereby increase radiation power and obtain a high level of utilization of the gain medium diameter and thus, harden a larger area in a smaller amount of time.

References of Interest

15. Marcatili (U.S. 3,573,656) and Cole, et al. (U.S. 4,951,285) are cited of interest to show the state of the art. Both Marcatili and Cole, et al. teach mode control and adjustment of a laser beam via the use of a pressure applying element such as a threaded member or plunger which alters the radius of curvature of a mirror. As the radius of curvature of the mirror is either increased or decreased, the beam diameter passing through the aperture is made larger or smaller, respectively. The smaller beam diameter suppresses or discriminates against the higher modes.

Response to Arguments

16. Applicant's arguments with respect to claims 12 – 15 have been considered but are moot in view of the new ground(s) of rejection. Applicant argued, in the response, filed April 10, 2007 and May 11, 2007 that the secondary reference of Friesem, et al. (U.S. 6,850,544) does not explicitly teach a switching element that actually switches the modal composition of the laser. However, to this point, the Examiner disagrees. Friesem, et al. teach that one mode control element can be used to select one mode or a set of modes of one polarization (column 16, lines 38 – 40). Thus, the mode control element *is capable of switching the modal composition of the laser.* Furthermore, Friesem, et al. continues to state that the mode control element is used to suppress *unwanted modes to thereby improve the quality of the output beam (column 12, lines 17 – 18).*

Applicant further argued none of the primary references previously cited (Mattes, Smith and Hirano) teach any switching or adjusting of the laser radiation. To this point, Examiner agrees. None of these references teach any adjustment of the laser radiation, but merely indicate that a radiation source is used in conjunction with the apparatus to form three-dimensional objects. Therefore, the Examiner has cited the reference of Serbin, et al. (U.S. 5,753,171). Serbin, et al. teach an apparatus for fabrication of three-dimensional objects by solidification of material layers. Furthermore, as indicated previously, Serbin, et al. teaches that adjustment of the laser radiation, specifically, the focus diameter, is crucial. During fabrication of the object, the envelope or contour of the object is solidified such that a small beam diameter is used to ensure accuracy and finer

solidification, while the core of the object is solidified using a larger beam diameter where accuracy or finer solidification is not as important; however, the production speed is faster (column 4, lines 30 – 47). Thus, as discussed in Applicant's arguments, Serbin, et al. endeavors to achieve high, dimensional accuracy and reduced hardening time.

In addition, though Serbin, et al. do not explicitly teach the use of a switching element, the reference teaches that laser beam adjustment is necessary during fabrication and thus, it would have been obvious to one of ordinary skill in the art to configure the apparatus of Serbin, et al. with the mode control element of Friesem, et al.

Conclusion

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maria Veronica D. Ewald whose telephone number is 571-272-8519. The examiner can normally be reached on M-F, 8 - 4:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dr. Yogendra Gupta can be reached on 571-272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

MVE

ROBERT DAVIS
PRIMARY EXAMINER
GROUP 1300/700

7/18/07